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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 09/900,771
Filing Date: July 06, 2001
Appellant(s): MASE ET AL.

MAILED

DEC 12 2005

GROUP 1700

Robert G. Gingher
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed October 4, 2005 appealing from the Office action mailed March 31, 2005.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is substantially correct. The changes are as follows: the reference referred to as "Bable et al." is really "Babel et al.".

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

6,176,453	LONG ET AL.	1-2001
5,296,285	BABEL ET AL.	3-1994
6,005,771	BJORNDAHL ET AL.	12-1999
4,669,685	DALBY	6-1987
5,439,706	RICHARDS ET AL.	8-1995
5,519,566	PERINO ET AL.	5-1996
5,527,767	SETSUNE ET AL.	6-1996
6,432,474	NAKANISHI ET AL.	8-2002

EP 0919647 A1 - OKAMOTO ET AL. (JUNE 2, 1999), entire reference

KR 2001-036859 A - Oh et al., (May 7, 2001), Derwent Abstract only

JP 11-162774 A - Kamigaki, (June 18, 1999), JPO Abstract only

JP 05-286702 A - Idemitsu Kosan CO LTD, (November 2, 1993), Derwent Abstract only

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

I. Claims 1, 4, 5, 8, 9, 12, 13, 15, 16 and 18 – 20 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Long et al. (U.S. Patent No. 6,176,453) in view of Okamoto et al. (EP 0919647 A1).

Claim 1 requires a composite material heat controller for an object, the composite material heat controller comprising: a base material that radiates a larger amount of heat at high temperature relative to that of at a low temperature, the base material having a surface adapted to thermally contact a surface of the object, and a phase change substance overlying the base material, wherein the phase change substance has insulation properties at a high temperature, metallic properties at a low temperature, and the phase change substance radiates a larger amounts of heat at high temperature relative to the amount of heat at low temperature, wherein the phase change substance has a high reflectivity in the thermal infrared region at low temperature, wherein said phase change substance comprises a thickness in the range from about one to about thirty microns.

Regarding these limitations, Long et al. (Long) teaches a radiator structure comprising a heat source 36 (equivalent to appellants claimed object), a radiator element 30 having an inner surface in thermal contact with the heat source through a thermal transfer medium 38, and a coating 44 in contact with the outer surface of the radiator element (*see figure 2a and column 4, lines 17-50*). It is the examiners position that the radiator body 30 and the coating 44 are equivalent to the appellants claimed base material that radiates larger amounts of heat at high temperature then at low temperature, wherein the base material has a surface that is adapted to thermally contact the object.

Long fails to teach a phase change substance that is about one to about thirty microns thick overlying the base material, wherein the phase change substance exhibits the properties required by claim 1 .

However, regarding this deficiency, Okamoto et al. (Okamoto) teaches a heat control device suitable for use on an artificial satellite or spacecraft (*column 1 , section 1*). This heat control device comprises a variable phase substance arranged on the heat radiation surfaces of a spacecraft. The variable-phase substance is a manganese perovskite oxide that undergoes a phase transition around room temperature. This substance has the characteristics of a metal at the low temperature phase, and the characteristics of an insulator at the high temperature phase. Further, this substance has a low heat radiation ratio at low temperature, and a high heat radiation ratio at high temperature (*column 2, section 11*). Figure 2 clearly shows that this material exhibits higher infrared reflectivity in the low temperature phase as opposed to the high temperature phase. Thus, the phase change material of Okamoto meets the material property requirements of claim 1 for the required phase change material. This phase-change material is mounted in the form of a film on the heat radiation surfaces of a spacecraft, and so is light-weight and space saving (*column 3, section 14*). Furthermore, this material regulates the amount of heat radiated from the surfaces of the spacecraft on order to control the internal temperature of the spacecraft (*column 1, section 2 and column 3 section 16*).

Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to coat the phase change coating of Okamoto onto the surface of the coated radiator panel taught by Long.

One would have been motivated to make such a modification due to the teaching in Okamoto et al. that coating the radiator panel of a satellite with a phase change material of a manganese perovskite oxide allows the internal temperature of a spacecraft to be passively controlled within a desired temperature range.

Regarding the requirement that the phase change substance comprise a thickness in the range of about 1 to about 30μ. The examiner acknowledges that neither Long nor Okamoto teach this limitation. The examiner further acknowledges that Okamoto teaches in a specific example that the phase change material is suitably a several hundred micron thick film (*column 3, section 17*). However, the recitation of a single suitable thickness by Okamoto does not teach away from using a film having any other thickness. Bearing this in mind, it is noted that the phase change film substance of Okamoto is configured so as to form a light-weight heat control device. Further, one of ordinary skill in the art of passive heat emission would understand that the thickness of a material will impact its heat radiative/conduction capabilities (*admitted in appellants arguments dated 05/20/2004*). In addition, it is well established that a thicker film of a substance necessarily weighs more than a thinner film of the same substance. Thus, the examiner takes the position that the thickness of the film of Okamoto is a results effective variable.

Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to control the thickness of the phase change film utilized by Long as modified by Okamoto to a desired range so as to obtain a coating having a balance between weight and desired heat radiation/conduction properties.

Claims 4 and 5 require the phase change substance to be a perovskite oxide (claim 4), more specifically manganese perovskite oxide (claim 5). These limitations are met as set forth above for claim 1.

Claim 8 requires a reflective plate or reflective film each having reflectivity with respect to visible light to be laminated onto the phase change substance on a side opposite the side on which the base material is laminated. Regarding this limitation, Okamoto et al. teaches that when the phase change material is mounted on a position that receives sunlight, a silicon plate that is transparent to thermal infrared but opaque to sunlight is positioned in front of the variable phase substance in order to minimize sunlight absorption (*column 4, sections 22-23*). As this silicon plate is opaque to visible light and is designed to minimize the absorption of sunlight, it is the examiners position that is will necessarily be reflective to visible radiation to some degree, and thus meets the reflection requirement in claim 8.

Therefore it would have been obvious to one with ordinary skill in the art at the time the invention was made to use the silicon plate taught by Okamoto et al. above the phase change material utilized by Long as modified by Okamoto et al.

One would have been motivated to make this modification due to the teaching in Okamoto et al. that the silicon plate minimizes the absorption of sunlight by a phase change material that is mounted on the surface of a satellite that is exposed to sunlight.

Claim 9 requires a surface of the base material to be affixed to a surface of the object either directly or through an intervening heat conductive substance. With respect to this limitation, Long teaches that the radiator panel is attached to the heat source via a thermal transfer medium 38. It is the examiners position that this thermal transfer medium is equivalent to *appellant*s claimed, "'heat conductive substance."

Claim 12 requires the object in claim 1 to include a circuit used in a space vehicle, including man-made satellites and spaceships. This limitation is met as set forth above for claim 1, as Long and Okamoto clearly are directed towards the management of heat on spacecraft such as satellites.

Claims 13, 15-16, and 18-20 require a generic method for controlling heat in an object, wherein the method merely requires "attaching," or "providing" the layers required in claims 1 , 4-5, 8-9 and 12. As the combination of Long with Okamoto necessarily requires these steps, the limitations of claims 13, 15-16 and 18-20 are met as set forth above for claims 1, 4-5, 8-9 and 12. 18.

II. Claims 3, 6, 7, 14 and 17 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Long et al. (U.S. Patent No. 6,176,453) in view of Okamoto et al. (EP 0919647 A1) as applied above, and further in view of Babel et al. (U.S. Patent No. 5,296,285).

Long et al. and Okamoto et al. are relied upon as described above.

Long as modified by Okamoto does not teach a composite material heat controller wherein the base material of claim 1 comprises a thickness greater then that of the phase change substance.

However, it is noted that Long teaches that a suitable radiator element comprises an aluminum or aluminum alloy body that has been coated with a layer of white thermal control paint (*column 4, lines 18-55*). Long does not disclose a suitable thickness for the radiator element and white paint coating. Bearing this in mind, Babel et al. (Babel) teaches a high emittance, low absorptance coating for an aluminum substrate comprising a layer of anodized aluminum on the substrate, and a layer of white paint on ' the anodized aluminum (*column 2, line 63-column 3, line 2*). This coating is used as a thermal control surface of a spacecraft (*column 4, lines 54-59*). Babel teaches that the thickness of the anodized aluminum substrate and the white paint coating is in the range of 1.5-8 mils (38-203μ) (*column 4, lines 44-53*). Further, Babel et al. teaches that the total thickness of the anodized aluminum and the high emissivity coating affects the corrosion resistance of the coating, with corrosion resistance increasing as the total thickness increases from 1-8 mils (38-203μ) (*column 3, lines 10-28*).

Therefore it would have been obvious to one of ordinary skill in the aft at the time the invention was made to utilize the anodized aluminum substrate coated with a layer of white paint taught by Babel as the radiator element in Long.

One would have been motivated to make this modification in light of the fact that Long teaches that an aluminum or aluminum alloy substrate coated with a layer of white paint is suitable for use as the radiator element, and the fact that the anodized aluminum substrate coated with white paint taught by Babel is specifically taught to be useable for this exact purpose.

Further, given the fact that the Babel teaches that the total thickness of the anodized aluminum and the high emissivity coating affects the corrosion resistance, with corrosion resistance increasing as the total thickness increases from 1.5-8 mils (38-2O3μ) (*column 3, lines 10-28*), the examiner takes the position that the thickness of the anodized aluminum substrate and white paint coating is a results effective variable.

Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to control the thickness of both the anodized aluminum substrate and white paint coating and the thickness of the phase change material to a desired ran Claim 6 requires the base material to have a thickness of 10-100μ. This limitation is met as set forth above for claim 3, when the thickness of the anodized aluminum/white paint radiator is controlled to thickness of 1.5mils (38μ).

Claim 7 requires the base material to include a material selected from the group consisting of silicone, alumina, and partially stabilized zirconia. This limitation is met as set forth above for claim 3, as anodized aluminum is known to have the formula Al_2O_3 which is also known in the art as alumina.

Claims 14 and 17 require a generic method of controlling heat in an object that requires "providing" or "forming" layers having the same limitations as claims 3 and 7. These limitations are met as set forth above for claims 3 and 7.

III. Claim 10 stands rejected under 35 U.S.C. 103(a) as being unpatentable over Long et al. (U.S. Patent No. 6,176,453) in view of Okamoto et al. (EP 0919647 A1) as applied above, and further in view of Bjorndahl et al. (U.S. Patent No. 6,005,771).

Long et al. and Okamoto et al. are relied upon as described above.

Long as modified by Okamoto fails to teach the limitations of claim 10, wherein the *appellant* requires the base of claim 1 to be attached to the object via an appropriate intervening adhesive.

However, it is noted that Long teaches that the radiator panel is attached to the heat source via a thermal transfer medium, wherein the thermal! transfer medium includes heat pipes, metallic strips, or other medium (*column 4, lines 44-50*).

Bearing the above in mind, Bjorndahl teaches that conduction of heat between a heat source (circuit) and a radiator panel can be improved by placing thermally conductive adhesive between the radiator panel and the heat source (*column 1, lines 38-50*).

Therefore it would have been obvious to one of ordinary skill in the ad at the time the invention was made to utilizes thermally conductive adhesive as taught by Bjorndahl between the heat source and the radiator panel of Long as modified by Okamoto.

One would have been motivated to make this modification in order to enhance the conduction of heat between the heat source and the radiator panel.

IV. Claim 11 stands rejected under 35 U.S.C. 103(a) as being unpatentable over Long et al. (U.S. Patent No. 6,176,453) in view of Okamoto et al. (EP 0919647 A1) as applied above, and further in view of Dalby (U.S. Patent No. 4,669,685).

Long et al. and Okamoto et al. are relied upon as described above.

Long as modified by Okamoto does not teach the requirements of claim 11, wherein the *appellant* requires the object to comprise a non-flat surface.

For the purpose of this examination the examiner interprets "object comprises a non flat surface" to require an object generating heat to have at least 1 non-flat/planar surface. The examiner does not interpret this claim to require that the base material and phase change material be curved. Thus, claim 11 is read on by a satellite having heat generating elements incorporating curved fins, wherein a radiator panel is in thermal contact with the heat generating element and a phase change substance exhibiting the properties recited in claim 1 is applied to the radiator panel surface opposite the heat generating elements.

Bearing the above interpretation in mind, Dalby teaches that the transfer of heat between heat generating elements and a heat radiator panel in a satellite is improved through the use of curved fins on the heat generating elements. Specifically, the use of curved fins allows heat generated from the heat producing elements to have a clear path to the heat radiator panel surrounding the heat-generating element (*column 5, lines 35-50*).

Therefore it would have been obvious to one of ordinary skill in the art to incorporate curved fins as taught by Dalby onto the heat generating elements taught by Long as modified by Okamoto.

One would have been motivated to make this modification in light of the teaching in Dalby that the transfer of heat between a heat generating element and a radiator panel in a satellite is improved by providing curved fins on the heat generating elements.

(10) Response to Argument

First, the Examiner notes that appellants have not prevented separate headings for each ground of rejection. However, since appellants have presented arguments directed exclusively to the independent claims, the Examiner has taken the position that appellants are essentially arguing that the claims stand and fall together and that no separate headings are required, since no separate arguments are presented for the grounds of rejection addressing solely independent claims – i.e. the rejections predicated on the combination of Long et al. in view of Okamoto et al. and further in view of tertiary references.

Regarding appellants arguments, appellants argue that the declaration of Mr. Okamoto, filed January 21, 2005, renders the invention patentable since "Mr. Okamoto states that it would not have been obvious to one skilled in the art to create a phase change layer of 1 – 30 microns thick from the readings of EP '647, because at the time, it was not known how to form a layer that had a thickness of less than 200 microns" (*appeal brief, page 5*). The Examiner respectfully disagrees.

The Examiner's response is summarized by appellants (*page 6 of appeal brief*) and will be repeated below to make the record clear. Specifically, the Examiner did not find the allegations made by Mr. Okamoto to be convincing, since Mr. Okamoto was not considering alternative methods of deposition of the phase change layer, such as sputtering versus the polishing and grinding method cited by Mr. Okamoto in the references journal article. The Examiner provided a large quantity of evidentiary art to refute the allegations of Mr. Okamoto that "it would not have been obvious to one skilled in the art to create a phase change layer of 1 – 30 microns". These references were summarized in the Conclusion section – Cited pertinent prior art of the Office action mailed March 31, 2005. They are:

- Derwent Abstract of KR-2001-036859-A teach depositing a perovskite manganese oxide to a thickness of 500 – 4000 Angstrom (0.05 – 0.4 microns) (*Abstract*);
- Richards et al. (U.S. Patent No. 5,439,706) teach an OMCVD method of depositing perovskite oxides on zirconia, alumina, silica to a thickness of 0.1 – 50 microns (*col. 2, lines 11 – 16 and lines 39 – 50; col. 3, lines 13 – 31; col. 4, line 65 bridging col. 5, line 8; and col. 6, lines 10 – 14*);
- Perino et al. (U.S. Patent No. 5,519,566) teach forming multiple layers of perovskite oxide layers, each having a thickness of 50 – 200 Angstroms (0.005 – 0.02 microns) (*col. 10, lines 6 – 51*);

- Setsune et al. (U.S. Patent No. 5,527,767) teach forming perovskite oxide layers having a thickness of around 3000 Angstroms (0.3 microns) (*col. 4, lines 49 – 65*);
- Nakanishi et al. (U.S. Patent No. 6,432,474 B1) teach forming perovskite oxide layers having a thickness of around 100 – 300 nm (0.1 – 0.3 microns) (*col. 4, line 43 bridging col. 5, line 13*);
- Kamigaki (JP 11-162774 A) teach perovskite oxide films having a thickness of 2 microns or less (*Abstract*); and
- Idemitsu Kosan Co LTD (JP 05-286702 A) teach perovskite oxide films having a thickness of 5 nm to 10 microns (*Abstract*).

Furthermore, the Examiner notes that Okamoto et al. (EP '647) does not recite *how* the phase change materials are formed, and is therefore not limited to a polishing and grinding method as argued by appellants. Second, the present claims are not directed to a polishing and grinding method, and therefore, appellants are essentially arguing limitations which are in the specification, which is not the measure of the invention. Appellants are reminded that limitations contained therein can not be read into the claims for the purpose of avoiding prior art. *In re Sporck*, 55 CCPA 743, 386 F.2d 924, 155 USPQ 687 (1968). Third, the Examiner has provided sufficient, non-refuted motivation as to why one of ordinary skill in the art would have been motivated to optimize the thickness of the results effective variable. Finally, the Examiner has provided a large number of evidentiary references refuting the allegation that films of the phase change materials disclosed by Okamoto et al. (EP '647) could not be formed to a thickness of less than several hundred microns.

Appellants further argue that the evidentiary references used to refute the declaration of Mr. Okamoto et al. must be cited in the basis of the rejection and appellants given the opportunity to address the combination of Long et al. with Okamoto et al. (EP '647) and a third reference (*page 6 of appeal brief*). The Examiner respectfully disagrees.

First, the Examiner notes that appellants were given ample time to consider the evidentiary art, since they were first cited March 31, 2005. Second, the Examiner does not agree with appellants contention that these references must be present in the basis of the rejection. These references are merely relied upon to refute the declaration of Mr. Okamoto. The thickness limitation is met for the reasons cited in the rejection of record (*i.e. results effective variable with motivation provided as to why one of ordinary skill in the art would have been motivated to optimize the thickness to appellants' claimed thickness range*). Since the present claims do not recite any process of forming the phase change material limitations, the Examiner sees no reason why the references refuting the declaration of Mr. Okamoto need to be present in the basis of the rejection.

Appellants further argue that the Examiner has applied improper hindsight in rejecting the claims by stating that the motivation for reduced thickness is deemed to be within the knowledge of one of ordinary skill in the art" (*page 7 of appeal brief*). The Examiner respectfully disagrees.

The Examiner notes that the concept of space exploration is *extremely* well known to a skilled artisan, especially a skilled artisan who is working on space-based applications such as satellites, which is the disclosed subject matter of both Long et al. and Okamoto et al. (EP '647). The Examiner maintains that one of ordinary skill in the art of space-based applications would have been very appreciative that weight is a crucial factor in *anything* sent into space. Given that weight and thickness are directly correlated, as duly noted in the rejection of record, the Examiner maintains that the obvious to optimize rationale was not predicated on improper hindsight reasoning. It is the Examiner's opinion that prior art is not read "in a box" excluding all outside influences, but must be consider as filtered through a mind of one of ordinary skill in the art.

Appellants further argue that the Examiner has "failed to show where the EP '647 reference teaches such motivation, i.e. (1) how to make a thinner phase change layer; (2) why a thinner phase change layer needs to be combined with an additional base layer, and (3) how such a combination could reasonably be expected to successfully remove heat from the object" (*page 7 of appeal brief*). The Examiner respectfully disagrees.

(1) is not a "motivation" *per se*, but rather appellants are arguing the lack of enablement of the reference EP '647, i.e. that one of ordinary skill in the art would not have been able to make the phase change materials disclosed in EP '647 to the claimed thickness values. This is addressed above with regard to Mr. Okamoto's declaration and the cited evidentiary art. (2) is addressed in the rejection of record, in

that the base layer is read upon by the radiator body. (3) is also addressed in the rejection of record, since Okamoto et al. (EP '647) teach the improved properties observed when using the claimed phase change material.

Finally, appellants argue that "there could be no reasonable expectation of success by merely reducing the thickness of the phase-change layer" (*page 8 of response*). The Examiner respectfully disagrees.

Appellants are reminded that an invention may be obvious if the prior art has different reasons for doing what the applicant has done. "It has long been held that a rejection under 35 USC 103 based upon a combination of references is not deficient solely because the references are combined based upon a reason or technical consideration which is different from that which resulted in the claimed invention." *Ex parte Raychem Corp.* 17 USPQ 2d 1417, 1424 (BPAI 1990). Cites *In re Kronig* 190 USPQ 425 (CCPA 1976); *In re Gershon* 152 USPQ 602 (CCPA 1967). While appellants are applying a "motivation for success" that is based on a implied large amount of heat radiation, the rejection of record addresses the fact that the thickness of the film is a value which must be optimized for a variety of reasons. Specifically, one is motivated to use high thickness values for improved quantity of heat radiated, but conversely, one is motivated to low thickness values to reduce the weight of the object to make it more feasible for space-based applications. There is a trade-off between these two known properties and one of ordinary skill in the art would have clearly recognized this trade off. It has been the Examiner's position, as elucidated in the rejection of record, that the thickness of the phase change material is merely an optimization of this known trade-off, and hence within the knowledge of one of ordinary skill in the art.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Kevin M. Bernatz

Kevin M. Bernatz, PhD
Primary Examiner

Conferees:

Carol Chaney CC

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